Synthesis

R&D Digest of Universiti Putra Malaysia

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Highlights from the next issue –

- *Tissue Culture Technologies*
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IPTA 2003 – Investing in Innovation

The second Public Institutions of Higher Learning (IPTA) Research & Development Exposition and Conference 2003 was hosted by Universiti Putra Malaysia (UPM) at the Putra World Trade Centre, Kuala Lumpur from 9 to 12 October 2003. This year's theme was *"Investing in Innovation"*.

The main objectives of the expositions were to publicise and promote research outputs and expose IPTA's research to the public and private sectors thus create market opportunities for research expertise both locally and internationally.

A total of about 475 exhibits from 17 institutions were on display. Out of which there were 57 exhibits (12%) from UPM. They were grouped into seven research clusters i.e., Agriculture, Food and Forestry (16); Bioscience and Biotechnology (6); Materials, Energy and Environment (2); Health and Allied Sciences (3); Information Technology and Mathematics (5); Science and Engineering (9); Social Sciences and Humanities (4). In addition there were 12 exhibits from UPM displayed in the main gallery.

Top exhibits were presented awards and medals sponsored by NGOs.

See 'Editorial' for details.

Vice-Chancellor, Dato' Zohadie Bardaie welcomes the Minister of Education, Tan Sri Musa bin Mohamad to the IPTA R&D Exposition 2003 at PWTC, KL on 9 Oct 2003

Production of Bacterial Inoculants as Biofertilizer and Bioenhancer

Zulkifli Hj.Shamsuddin
and Premalatha Pakirisamy

Award*Winner*

In Malaysia there are limited sources of bacterial inoculants as plant biofertilizers and bioenhancers. Plant growth-promoting rhizobacteria (PGPR) such as *Azospirillum* and *Bacillus* spp. can be safely used as inoculants to enhance plant growth, fix N_2 and decrease reliance on inorganic nitrogenous fertilizers. Several experiments were conducted to produce the inoculant namely the isolation of bacteria, the carrier and its shelf life, and the efficacy on economic crops.

Inoculant application efficacy: 10^8 to 10^9 cfu applied at planting of banana seedlings (nursery stage) and reinoculated monthly

Inoculation with RGRP promotes roots development and vegetable soybean compared with un-inoculated controls (side tubes)

Application of Ground Oil Palm Frond PGPR inoculum carrier to young oil palm nursery seedlings

Results showed that *Bacillus* sp. UPMB10 was able to grow and multiply in coir dust (CD), ground oil plam frond (GOPF) and KUSOKOM® compost (KC) at all temperature treatments (20°,30°,40°). GOPF supplemented with 25% KC showed highest growth after 5 1/2 months (10^8 cfu/g inoculant) when stored at 30°C and moisture potential pF 2.54. Inoculation test with oil palm seedlings *in vitro* showed an accumulation of 47- 67% N from atmosphere (Ndfa); rhizobacterial inoculation contributed 30% Ndfa (350mg N plant^{-1} 260 days^{-1}) through N_2 fixation. PGPR inoculant also increased growth of root (42%) and top (19%). For banana, the root of PGPR-inoculated plants produced higher acetylene-reduction assay (ARA) activities (129 µmole plant^{-1} hour^{-1}) and increased nutrient uptake.

In conclusion, these results strongly indicate the viability of using *B. sphaericus* UPM10 with GOPF and KC as inoculant carriers to commercially produce a bacterial inoculant for various economic crops, namely oil palm and bananas.

TOP WINNER Malaysian Society of Plant Physiology (MSPP) Award – IPTA Research & Development Exposition 2003.

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EDITORIAL

Working together to raise standards

The IPTA Research and Development Exposition 2003 jointly organised by Ministry of Education Malaysia and Public Institutions of Higher Learning and hosted by Universiti Putra Malaysia (UPM) from 9-12 October at PWTC, Kuala Lumpur added another feather on to the UPM's hat. It was once again a proud moment for Universiti Putra Malaysia when 10 of its scientists were declared winners and awarded medals in the *IPTA Research & Development Exposition 2003* in different categories.

Dr. Zulkifli Hj. Shamsuddin, Professor of Soil Microbiology from Agriculture faculty was declared the Malaysian Society of Plant Physiology (MSPP) top winner for his research entitled, "Production of Bacterial Inoculants as Biofertilizer and Bioenhancer".

Dr. Maziah Mahmood, Professor of Biochemistry and Microbiology also won the Malaysian Society of Plant Physiology (MSPP) 'MERIT' award for her two research projects entitled "Commercial Production of Economically Important Planting Materials Using Tissue Culture Technologies" and "Genetic Engineering of Bananas for Tolerance to Fusarium Wilt Disease". In addition, Professor Maziah also won an award under the Plant Genetic category (Malaysian Genetic Society) for her research entitled "Genetic Engineering of Bananas for Tolerance to Fusarium Wilt Disease".

Associate Professor Dr. Abdul Rahman Ramli from Faculty of Engineering won the PIKOM award for his research on SMS Gateway Interface.

Professor Dr. Ahmad Said Sajap from Faculty of Forestry won a Malaysian Plant Protection Society (MPPS) Gold medal for his research invention on Development of Biopesticide for Managing Cruciferous Vegetable Pest.

Associate Professor Dr. Hiryati Abdullah from Faculty of Agriculture won a Malaysian Plant Protection Society (MPPS) Bronze medal for her research on An Integrated Management for the Control of Bacterial Wilt of Tomato Caused by *Ralstonia Solanacearun*.

Dr. Abdul Halim Shaari, Professor of Physics from the Faculty of Science and Environmental Studies won a Malaysian Solid State Science & Technology Society (MASS) 2003 award for his research on Low Field Magnetoresistance of Manganites Perovskites Bulks and Films for Sensing Devices.

Professor Dr. Radin Umar Radin Suhadi and Associate Professor Dr. Fakhru'l-Razi B Ahmadun from the Faculty of Engineering also received the Malaysian Solid State Science & Technology Society (MASS) 2003 awards for their research entitled "Design of Cost Effective and Comfortable Motorcycle Helmet With Bio-Composite Material for Tropical Climates" and "Carbon Nanotubes and Carbon Nanofibers Synthesis for Nanotechnology Applications" respectively.

Associate Professor Dr. Rozita Rosli from Faculty of Medicine and Health Sciences won the Malaysian Genetic Society award under the 'Microbe Genetic' category for her research entitled, "Cholera DNA Vaccine" and Dr. Jothi Malar Panandam from the Faculty of Agriculture also won the Malaysian Genetic Society award under the 'Animal Genetic' category for her research on Genetic Variability of Four Sheep Breeds in Malaysia. RMC

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SPOTLIGHT

Academic Writing

If the reader is to grasp what the writer means, the writer must understand what the reader needs

Science is often hard to read. Most people assume that its difficulties are born out of necessity, out of the extreme complexity of scientific concepts, data and analysis. Complexity of thought need not lead to impenetrability of expression; number of rhetorical principles can produce clarity in communication without oversimplifying scientific issues. The results are substantive, not merely cosmetic: Improving the quality of writing actually improves the quality of thought.

The fundamental purpose of scientific discourse is not the mere presentation of information and thought, but rather its actual communication. It does not matter how pleased an author might be to have converted all the right data into sentences and paragraphs; it matters only whether a large majority of the reading audience accurately perceives what the author had in mind. Therefore, in order to understand how best to improve writing, we would do well to understand better how readers go about reading. Such an understanding has recently become available through work done in the fields of rhetoric, linguistics and cognitive psychology. It has helped to produce a methodology based on the concept of reader expectations.

Let us begin with the statement that, as far as the language is concerned, there is no difference between Academic Writing (AW) and ordinary writing. It is governed by all rules of grammar of the language (English). There are sentences with subject, verb and object (adverbs, adjectives, etc.).

- Therefore, Academic Writing is an art of writing.
- It depends on the writer and the intention. Academic Writing is definitely different from those written for making love, joking or a political speech. Academic Writing is serious business, recording events in a systematic manner and written by members of the academic community whether they are professors, lecturers, scientists or university graduates to convey their contributions to knowledge.
- I am sure that there are many who can boast or talk about their achievements but when asked to put down in writing will not hesitate to reply – busy no time. Why? Once in writing you can be challenged!
- It is the ability to write (communicate) will determine your success or failure within the scientific community.
- You may be a good researcher but your investigations are incomplete without publishing the results. Many research projects remain unpublished because the researcher is unable to write.
- AW deals with putting your thoughts, findings into print for others to know what you have done or doing in printed form – Publications – similar to the contributions of an artist.
- You can document your research in the form of a thesis, dissertations, journals, proceedings of conferences, books, chapters or consultancy/ technical reports but because of the very rigid format of these publishers, most researchers fail to get their findings published.
- Academic Writing is not difficult to acquire if you follow the guidelines of the publisher and read the documents thoroughly, you will find that they are well structured and your ability to write will gradually improve with the passage of time.
- ICT has revolutionised Academic Writing. MS word is recommended for you to improve your English, spelling, and choice of words. It even helps in your grammar and thesaurus
- To get surprising ideas, extensive reading is important. Young people fail to realise the importance of it. You cannot just sit there looking at your apparatus. You have to read a lot before you get new ideas! RMC

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Design and Fabrication of CVD (Chemical Vapour Deposition) for Nanotechnology Research (Carbon Nanotube and Carbon Nanofibre Synthesis)

Fakhru'l-Razi Ahmadun, Muataz Ali Atieh, Iyuke Sunny Esayegbemu, Maan Fahmi Alkatib, Dayang Radiah Awang Biak, Abdul Ghani Liew Abdullah, Faizah Mohd Yasin, Mohd Halim Shah Ismail and Abdul Hamed Belal Danna

Research on new materials technology is attracting the attention of researchers all over the world. Developments are being made to improve the properties of the materials and also to find alternative precursors that can bestow desirable properties on the materials. Great interest has recently developed in the area of nanostructured carbon materials. Carbon nanostructures are gaining considerable commercial importance with interest growing rapidly over the decade or so since the discovery of Buckminster fullerenes, carbon nanotubes, and carbon nanofibers.

There are many methods of producing these nanomaterials, including electric arc discharge, laser evaporation, chemical vapor deposition (CVD), and plasma-enhanced CVD, among many others. Among these, CVD seems to be the most promising method for possible industrial scale-up due to the relatively low growth temperature, high yields and the high purities that can be achieved. These nanomaterials have a range of promising properties, including unique mechanical and electrical behavior and are under investigation for a wide range of practical applications such as field emission displays, hydrogen storage, nanocomposites, and fuel cells.

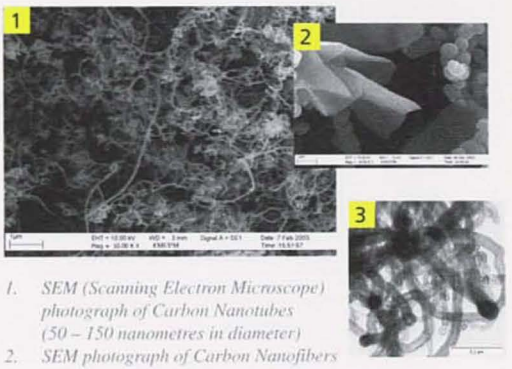
Though in Malaysia this kind of research is relatively new, and if no initiative is taken by the researchers here, Malaysia will be left behind in this field of technology and will be totally dependent on foreign suppliers for its needs in this area. This research on nanotechnology is the door for many coming and promising technologies and their enormous beneficial applications. In order to follow up with the existing global trend in technology, the Department of Chemical and Environmental Engineering, Universiti Putra Malaysia, initiated a research on carbon nanotubes production in October 2001. Carbon nanotubes and carbon nanofibres are the building blocks of nanotechnology research. Carbon nanotubes can exhibit tensile strength of upto 100 times greater

CVD model designed and fabricated in UPM

than steel but it is 6 times lighter. This research requires the setting up of an equipment called the Chemical Vapour Deposition (CVD) unit. As this type of research did not exist in Malaysia before, such equipment (i.e. CVD) was not available. Therefore, as a start, the idea of buying the CVD was a first choice, however the exorbitant cost of the equipment (~ RM 900k) besides the excessive time taken to deliver it from overseas have spurred the group of researchers to develop their own design of the CVD and build it from locally available materials. Thus, the cost (~ RM 100k) and time of this research have been dramatically reduced.

Not only to speak of the reduction of cost and time achieved at UPM, the availability of the CVD will boost the research in the field of nanotechnology in Malaysia as this will encourage lots of researchers who lack the facility and funding to run and start similar researches. A Malaysian patent has been filed for the UPM CVD. We look forward to industrial collaboration to further enhance nanotechnology R&D for the country.

So far, the outcomes of this research at the Department of Chemical and Environmental



1. *SEM (Scanning Electron Microscope) photograph of Carbon Nanotubes (50 – 150 nanometres in diameter)*
2. *SEM photograph of Carbon Nanofibers (< 100 nanometres thickness) using the CVD unit*
3. *TEM image of a bundle of the Carbon Nanotubes synthesized by the CVD*

Engineering, University Putra Malaysia, have been very impressive and encouraging. Being first time produced in Malaysia, carbon nanotubes produced in our labs using our new design of CVD have shown very high quality and astonishingly consistent, and comparable with other researchers worldwide who produced carbon nanotubes. Other carbon nanomaterials produced include carbon nanofibers, carbon nanoparticles, and a new material we named carbon nanoporous balls. RMC

WINNER *Malaysian Solid State Science & Technology Society (MASS) Award – IPTA Research & Development Exposition 2003.*

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Development of Biopesticide for Managing Cruciferous Vegetable Pest

Ahmad Said Sajap, Mohammad Abdul Bakir, Hussan Abdul Kadir and Norani Abdul Samad

This research reveals the potential of a nucleopolyhedrovirus for development of a biopesticide for managing cruciferous vegetable pests.

In this study an armyworm *Spodoptera litura* (Fabricius) (Lep., Noctuidae), an important pest of many crops including cruciferous vegetables, was selected. The virus, coded as SpltNPV, originally isolated from Telong, Kelantan, was tested for its infectivity to the armyworm at different temperature, pH and ultraviolet radiation.

The result shows that mortality significantly increased by 47% from 53% when the larvae were reared at 20°C to 100% at 30 and 35°C. The LT_{50} values decreased from 24 to 6 days. All virus suspension used in the experiment induced mortality to more than 90% except in pH 11, where it was 64% and 100% mortality was recorded from pH 7. The LT_{50} increased to about four folds when the pH of suspension was increased from 7 to 11. SpltNPV was, however, adversely affected by UV-light. Laboratory and field trials using UV-protectants show that the virus remained infective and subsequently gave a comparable yield of *Brassica rapae* as compared with that of the chemically treated crop.

Thus SpltNPV has the potential to be commercially developed for biopesticide of armyworm, *S. litura*. RMC

GOLD – Malaysian Plant Protection Society (MPPS) Award – IPTA Research & Development Exposition 2003.

Reader Enquiry

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Genetic Engineering of Bananas for Tolerance to Fusarium Wilt Disease

Award Winner

Maziah M , Sreeramanan S., Abdullah M.P., and Sariah .M.

Fusarium Wilt disease causes severe damage in commercial plantations and represents a major constraint to banana production in Malaysia. Control measures involving field sanitation, soil fumigation, organic amendments and crop rotation are non-effective.

An effective method of controlling Fusarium wilt is by planting new tolerant varieties. Conventional breeding is hampered by high sterility, polyploidy and long generation time of most cultivated banana cultivars. Genetic engineering offers as an alternative route to increase resistance to pathogens in plants. Establishment of a reliable transformation and regeneration system is essential for genetic engineering. Biolistic was initially chosen as the method for banana transformation using tiny single meristem buds as it has been the most successful transformation system for monocotyledon plants. Optimisation of physical and biological parameters, including testing of selection agents (kanamycin, basta, hygromycin , geneticin G-418, neomycin and paromomycin), was carried out as a prerequisite for stable transformation. This has resulted in the successful transfer of reporter genes (GFP and GUS) into banana, thus making it possible to improve banana via genetic engineering. Besides application of the Biolistic method, a study on transformation-mediated system by *Agrobacterium* has also been carried out.

In our attempt to optimize and improve *Agrobacterium*-mediated transformation, several parameters were evaluated based on GFP and GUS transient gene expressions. Upon extensive revision of the regeneration and improved selection protocol, transgenic bananas were produced by use of two different *Agrobacterium* strains (EHA 101 and LBA 4404) using chitinase and β-1,3-glucanase genes. The majority of transgenic banana plants produced were morphologically normal and independent transformants have been confirmed by the Polymerase Chain Reactions (PCR) to contain reporter genes, selectable marker gene (*npt* 11) and the antifungal genes. The presence and estimated copy number of inserts were detected by Southern Blot hybridizations. Plantlets from the chitinase and β-1,3-glucanase positive plants were tested for their resistance to the *Fusarium oxysporium f.sp cubense* spores using optimised conditions. The degree of resistance displayed by these transgenic plantlets was correlated with the level of the genes expression and different gene combinations.

Genetically modified Fusarium wilt tolerant bananas produced would overcome many of the risks associated with pesticide uses and they are safe for consumers.

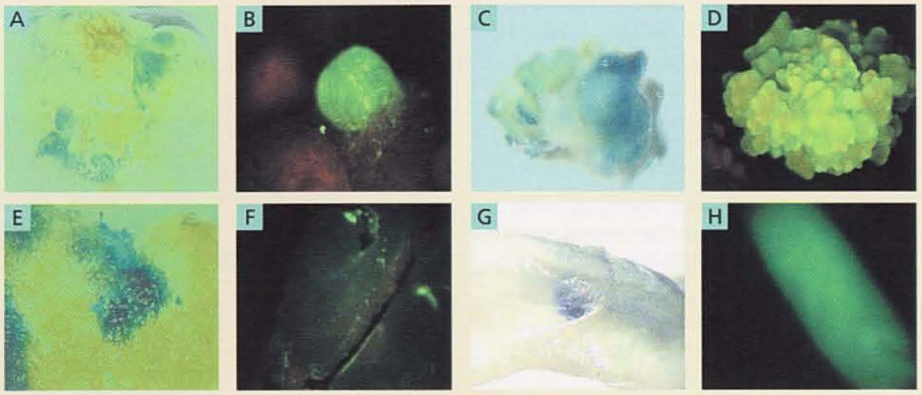

Plate 1. *Visualisation of stable gusA (A, C, E and G) and gfp (B, D, F and H) genes expression in various tissues of banana A and B: Single buds; C and D: Multiple bud clumps (Mbcs); E and F: Leaves; G and H: Roots*

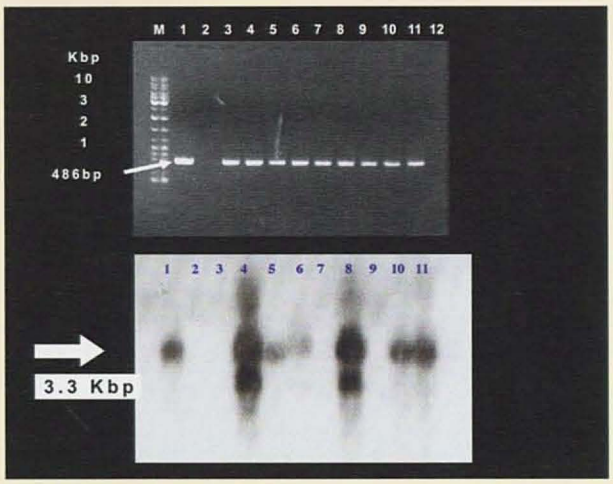

Plate 2. *PCR and Southern blot analysis of the chitinase and β-1,3-glucanase genes in transgenic banana plantlets*

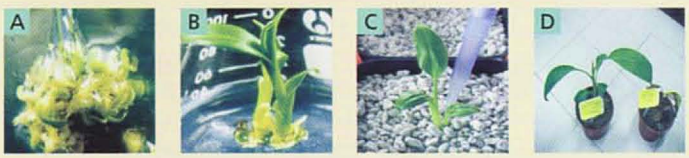

Plate 3. *(A) Multiple shoots were separated into separated and maintained in BAPhormone, (B)Two single plantlet resistant to antibiotic selection were developed and confirmed from PCR and Southern Blot analyses .(C) Inoculums of Fusarium conidial suspension in transgenic banana,(D) Transgenic banana tolerances to Fusarium wilt disease.*

MERIT *Malaysian Society of Plant Physiology (MSPP) Award – IPTA Research & Development Exposition 2003.*

WINNER *Malaysian Genetic Society Award (Plant Genetic category) – IPTA Research & Development Exposition 2003.*

Reader Enquiry

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Cholera DNA Vaccine

Rozita Rosli, Mariana Nor Shamsudin, Abdul Rahman Omar, Shahrilnizam Abdullah and Lama Hamadneh

Award*Winner*

In circumventing many of the drawbacks of traditional cholera vaccines, a new generation vaccine - a cholera DNA vaccine was constructed. The present invention relates to a plasmid (pVax) carrying a *Vibrio cholerae* gene (ctxB).

This approach of using DNA involves delivering the gene sequence of the desired antigen into the host by inserting the gene for the antigen via a replicating plasmid vector, such that a strong and broad-based immune response is produced. Initially, expression of the ctxB antigen cloned in pVax was achieved *in vitro* using COS-7, a eukaryotic cell line. This was followed by *in vivo* immunogenicity testing involving Balb/c mice.

The present invention was injected intramuscularly into the mice in a simple saline solution using a technique that had been previously validated. Humoral response was induced where IgG levels increased after the booster injection. The present invention offers a cholera DNA vaccine that demonstrates protective efficacy in mice challenged with clinical isolates of *Vibrio cholerae*.

Hence, this gives a measure of success in developing an effective cholera vaccine applicable to humans.

Being a DNA vaccine rather than a protein, the invention is inexpensive, stable, easy to produce, does not need refrigeration-qualities that make feasible its widespread use in developing countries where cholera is still a problem.

WINNER *Malaysian Genetic Society Award (Microbe Genetic category) – IPTA Research & Development Exposition 2003.*

Reader Enquiry

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Detection of lard in Chocolate by Fourier Transform Infrared (FTIR) Spectroscopy for 'Halal' Authentication

Yaakob B. Che Man, Syahariza Bt. Zainul Abidin, and M.E.S. Mirghani

Award*Winner*

Determination of food authenticity and detection of adulteration are major issues in the food industry, causing concern among consumers and demand special attention among food manufacturers. Lard is commonly blended with other fats in food for economic reasons but draws controversy among certain group of consumers due to its implications on religion and health. The Fourier Transform Infrared (FTIR) Spectroscopy has proven to be a fast and reliable technique in detecting adulterants in food. The FTIR spectroscopy in combination with attenuated total reflectance (ATR) and partial least square (PLS) regression was used to detect addition of lard in chocolate formulation. The spectral bands associated with lard, cocoa butter and their blends (ranging from 0 - 15% of lard in cocoa butter) were recorded, interpreted and identified. A semi quantitative approach is proposed to measure the percentage of lard in blends on the basis of spectral data at frequency region of 4000-650cm-1, using the equation $y = 0.9225x + 0.5539$. The coefficient of determination (R2) was 0.9872 with a standard error (SE) of 1.305.

In this study, the potential of FTIR spectroscopy as a rapid analytical tool for the quantitative determination of adulterant especially lard in chocolate is demonstrated.

GOLD – UPM Invention & Research Exhibition 2003.

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Research

IPTA Research & Development Exposition 2003 *(9-12 October 2003)*

From Left: Deputy Vice Chancellor (Academic), Professor Muhamad Awang, En. Jamal (Eco event), Dato' Zobadie and Prof. Radin Umar

From Left: RMC director, Assoc. Prof. Dr. Mohd Shahwahid, Prof. Radin Umar, Dato' Zobadie, En. Jamal (Eco event) and Prof. Zulkifli (at the back) during the pre-inspection of the exhibits

From Left: Prof. Shamsher and Professor Wan Ishak with Prof. Makhdzir Mardan

Commercialisation of R&D display at the main gallery at PWTC

Dato' Zobadie presents a souvenir to Tan Sri Musa at the opening of the R&D Exposition

Deputy Vice-Chancellor (Academic), Professor Muhamad Awang in a lighter mood with a postdoctorate researcher, Dr. Eng. Abdul Hamid Assilzadeh

Tan Sri touring

Eng. Mustaz Ali (at the right) explains his exhibit (Nanotechnology) to Tan Sri Musa

Dr. Abdul Rashid Mohamed Shariff (left) demonstrates his research project to Tan Sri Musa while Dr. Eng. Abdul Hamid Assilzadeh looks on

Tan Sri Musa congratulating Assoc. Prof. Dr. Maznah Ismail for her research on Rice Bran

Professor Zulkifli receiving the top winner Malaysian Society of Plant Physiology (MSPP) award from a representative of MSPP

Professor Maziah Mahmood won the Malaysian Society of Plant Physiology (MSPP) 'MERIT' award for her two research projects. In addition, she also won an award under the Plant Genetic category (Malaysian Genetic Society)

Assoc. Prof. Sidek being honored to present an award to a recipient under the Health and Allied Sciences category

Happenings

From Left: Prof. Shamsher and Assoc. Prof. Dr. Mohd. Shahwahid discussing about Impact of Commercialization on R&D

Vice-Chancellor, Dato' Zohadie and Deputy Vice-Chancellor (development) Prof. Makhdzir Mardan welcoming the Minsiter of Education, Tan Sri Musa on his arrival at PWTC

Exhibits displayed by cluster—Agriculture, Food & Forestry exhibits on display during IPTA 2003

Musa accompanied by Dato' Zohadie the exhibits at the main gallery

A list of 69 MOUs/MOAs signed by 11 universities during 2002 and 2003 draws Tan Sri Musa's attention during a tour of exhibits with Dato' Zohadie

Dr. Mohd. Shahwahid explains about Commercialisation of R&D to Tan Sri Musa while Prof. Shariff looks on

Assoc. Prof. Dr. Maznah Ismail shows her exhibit on Rice Bran research to Tan Sri Musa while Dato' Zohadie looks on with a keen eye

Assoc. Prof. Dr. Norhani Abdullah explains her exhibit on avian egg yolk antibody to Tan Sri Musa

Dr. Ishak Aris shows his exhibit to Tan Sri Musa

Dato' Zohadie presenting an award on behalf of the Institute of Engineers Malaysia (IEM) to a recipient

Dr. F.M. Shuaeib receiving Malaysian Solid State Science & Technology Society (MASS) award 2003 from MASS President, Prof. Dr. Muhammad Yahya

Dr. Jothi Malar Panandam from the Faculty of Agriculture along with her co-researchers won the Malaysian Genetic Society award under the Animal Genetic category

Low Field Magnetoresistance in Bulks and Films of Manganite

Perovskites for Sensing Devices

Abdul Halim Shaari, Lim Kean Pah, Hishamuddin Zainuddin, Chow Sai Pew, Sidek Hj. Abdul Aziz, Noorhana Yahya, Abdullah Chik and K.K.Kabashiand Huda Abdullah

Award Winner

In the current technological revolution where electronics devices continue to decrease in size and cost, the need for smaller, low-cost and high-performance sensors dramatically increases. The capacity of the hard disk in the computer grows dramatically in the last decade. As the capacity of the memory drives get higher, the stored bits of data get smaller. Therefore, their magnetic field gets weaker and making the bits harder to detect and read. The key is to make magnetic sensor head (Figure 1) that can read smaller and lower magnetic field.

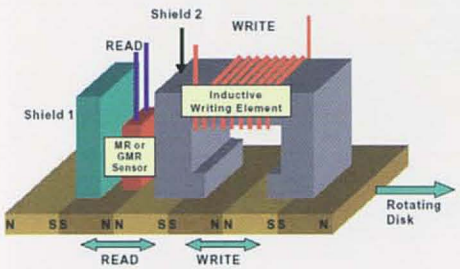

Figure 1. Read-write head sensor Image obtained from IBM homepage

Manganite perovskite, which exhibit Colossal Magnetoresistance (CMR) effect, is one of candidates that offer promising properties to utilize as the magnetic field sensing head. Monocrystalline manganite perovskites materials show intrinsic CMR effect arising from the Double exchange (DE) where the maximum CMR value occurred near Curie temperature (T_C) and metal-insulator transition temperature (T_{MI}) concurrently. In polycrystalline manganite, another contribution of extrinsic CMR occurred, due to the grain boundaries effect, namely Low Field Magnetoresistance (LFMR). In this work, polycrystalline $La_{1-x}A_xMnO_3$ (A=Ca,Ba,Sr) of bulks and films have been prepared via solid state reaction and Pulsed Laser Deposition techniques (Figure 2) respectively.

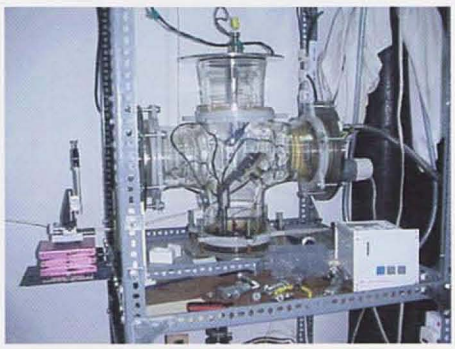

Figure 2. Pulsed Laser Deposition System

$La_{1-x}Sr_xMnO_3$ (LSMO) and $La_{1-x}Ba_xMnO_3$ (LBMO) bulk samples show significantly large CMR value of 4% (Figure 3) and 6% at an applied field of 0.1 Tesla measured at room temperature. When the applied field is increased to 1 Tesla, the CMR value increases slowly to 8% (Figure 3) and 11% respectively. These samples show strong LFMR effect, where MR value increases with the decrease of temperature below Tc.

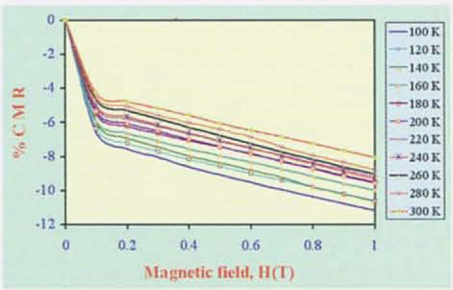

Figure 3. CMR value as a function of magnetic field at various temperatures for La-Sr-Mn-O bulk

Polycrystalline films show similar properties given by bulk samples. However, the CMR values for the thin films are not thickness dependent (Figure 4).

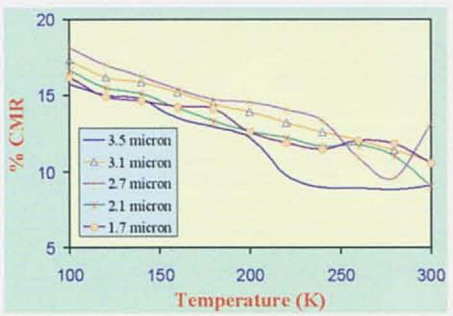

Figure 4. CMR value as a function of temperature for La-Sr-Mn-O film at various thickness

The wide range of particles size distribution as shown by SEM (Figure 5) and AFM (Figure 6) occurred in the films, which contributed to a large number of grain boundaries, and hence resulting significant LFMR effect.

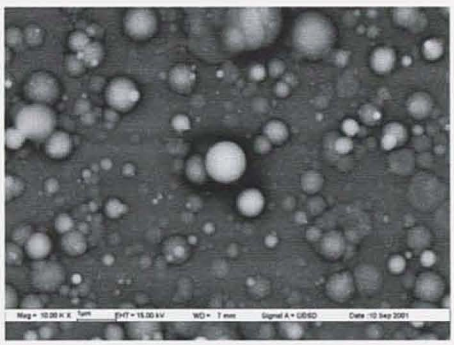

Figure 5. SEM micrograph

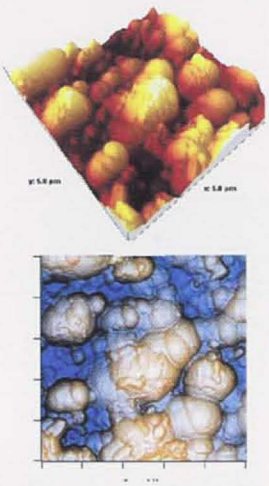

Figure 6. AFM image of film

Polycrystalline LSMO and LBMO films are promising sensor elements that can be applied in both low field (below 0.1Tesla) and medium field (0 to 1 Tesla) sensing devices.

***WINNER** Malaysian Solid State Science & Technology Society (MASS) Award – IPTA Research & Development Exposition 2003.*

Reader Enquiry

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Environmental Friendly Synthetic Lubricant from **Palm Oil**

Robiah Yunus, Fakhru'l-Razi Ahmadun, Ooi Tian Lye, Azni Idris and Sunny M. Iyuke

There is an increasing interest in the development of alternative lubricating oils from renewable resources as compared to non-renewable, non-biodegradable petroleum-based fluids. Considerable research efforts have been spent on the use of renewable fats and oils particularly on vegetable oils as alternative base stocks in lubricating oil formulation. However, its inherent characteristics such as inadequate oxidative stability, poor corrosion protection, and poor low temperature performance have been recognized as major impediments to their potential use as lubricants. However, many studies have indicated ways that can be applied to overcome these problems including structural modifications via epoxidation or transesterification.

In this study, a new palm based lubricant was synthesized via chemical transesterification of palm based methyl esters with trimethylolpropane, (TMP). Both palm oil and palm kernel oil methyl esters were used as the starting materials and sodium methoxide as the catalyst. A new analytical technique using gas chromatography was developed to analyze the reaction products: TMP, palm based methyl esters, monoesters, diesters and triesters. The kinetics study on transesterification established that the reactions occurred via three stepwise and reversible reactions. The lubrication properties of palm oil-based TMP esters indicated good potential as base stock in biodegradable lubricant formulation. The properties such as viscosity, VI, wear and friction properties are comparable to commercial hydraulic fluids. The pour point (PP) problem associated with the saturation level in palm oil was resolved, as the pour point was successfully improved to –32°C in high oleic palm based TMP esters. The presence of hydroxyl group has positive effect on wear and friction as well as oxidative stability.

With proper additives, it is believed that the new formulated high oleic palm oil TMP ester will offer a wide variety of applications: hydraulic fluids, fire resistant fluids, metalworking fluids, and general lubricating oils. Its unique chemistry offers excellent oxidative and thermal stability, superior low temperature behaviour, and biodegradability.

GOLD – UPM Invention & Research Exhibition 2003.

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SMS *Gateway Interface*

Abdul Rahman Bin Ramli, Tuan Syed Abdul Rahman Bin Syed Mohamed and Beh Kok Siang

GSM Short-Message-Service (SMS) is common text-base communication method using mobile phone. This project provides a low cost solution for remote monitoring and controlling via SMS. The system can be setup in any location with GSM coverage in short duration. Various sensors and control instrument can be interfaced into the system. Motion sensors, temperature, alarm, water level are examples of sensors that can be interfaced to the system.

The system can automatically send feedback to person-in-charge or a central data collection center via SMS in case any defined condition occurs. Instruments such as heaters, latches, motors, bells, lights and computers can be controlled from a remote location. Commands can be pre-defined and then sent via SMS to the system to check latest status. Security issues are also being taken care of via a phone number that is pre-defined can access the system. Once the system receives SMS Commands from an authorized user, the system will perform the necessary command to control the various instruments connected to the system. Full LOGs are recorded in the computer that provides all the necessary details for every incoming and outgoing SMS.

***WINNER** PIKOM – IPTA Research & Development Exposition 2003*

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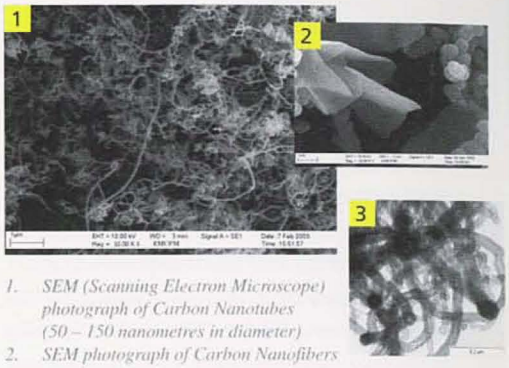
Design and Fabrication of CVD (Chemical Vapour Deposition) for Nanotechnology Research

(Carbon Nanotube and Carbon Nanofibre Synthesis)

Fakhru'l-Razi Ahmadun, Muataz Ali Atieh, Iyuke Sunny Esayegbemu, Maan Fahmi Alkatib, Dayang Radiah Awang Biak, Abdul Ghani Liew Abdullah, Faizah Mohd Yasin, Mohd Halim Shah Ismail and Abdul Hamed Belal Danna

Award Winner



1. *SEM (Scanning Electron Microscope) photograph of Carbon Nanotubes (50 – 150 nanometres in diameter)*
2. *SEM photograph of Carbon Nanofibers (< 100 nanometres thickness) using the CVD unit*
3. *TEM image of a bundle of the Carbon Nanotubes synthesized by the CVD*

Research on new materials technology is attracting the attention of researchers all over the world. Developments are being made to improve the properties of the materials and also to find alternative precursors that can bestow desirable properties on the materials. Great interest has recently developed in the area of nanostructured carbon materials. Carbon nanostructures are gaining considerable commercial importance with interest growing rapidly over the decade or so since the discovery of Buckminster fullerenes, carbon nanotubes, and carbon nanofibers.

There are many methods of producing these nanomaterials, including electric arc discharge, laser evaporation, chemical vapor deposition (CVD), and plasma-enhanced CVD, among many others. Among these, CVD seems to be the most promising method for possible industrial scale-up due to the relatively low growth temperature, high yields and the high purities that can be achieved. These nanomaterials have a range of promising properties, including unique mechanical and electrical behavior and are under investigation for a wide range of practical applications such as field emission displays, hydrogen storage, nanocomposites, and fuel cells.

Though in Malaysia this kind of research is relatively new, and if no initiative is taken by the researchers here, Malaysia will be left behind in this field of technology and will be totally dependent on foreign suppliers for its needs in this area. This research on nanotechnology is the door for many coming and promising technologies and their enormous beneficial applications. In order to follow up with the existing global trend in technology, the Department of Chemical and Environmental Engineering, Universiti Putra Malaysia, initiated a research on carbon nanotubes production in October 2001. Carbon nanotubes and carbon nanofibres are the building blocks of nanotechnology research. Carbon nanotubes can exhibit tensile strength of upto 100 times greater

CVD model designed and fabricated in UPM

than steel but it is 6 times lighter. This research requires the setting up of an equipment called the Chemical Vapour Deposition (CVD) unit. As this type of research did not exist in Malaysia before, such equipment (i.e. CVD) was not available. Therefore, as a start, the idea of buying the CVD was a first choice, however the exorbitant cost of the equipment (~ RM 900k) besides the excessive time taken to deliver it from overseas have spurred the group of researchers to develop their own design of the CVD and build it from locally available materials. Thus, the cost (~ RM 100k) and time of this research have been dramatically reduced.

Not only to speak of the reduction of cost and time achieved at UPM, the availability of the CVD will boost the research in the field of nanotechnology in Malaysia as this will encourage lots of researchers who lack the facility and funding to run and start similar researches. A Malaysian patent has been filed for the UPM CVD. We look forward to industrial collaboration to further enhance nanotechnology R&D for the country.

So far, the outcomes of this research at the Department of Chemical and Environmental Engineering, University Putra Malaysia, have been very impressive and encouraging. Being first time produced in Malaysia, carbon nanotubes produced in our labs using our new design of CVD have shown very high quality and astonishingly consistent, and comparable with other researchers worldwide who produced carbon nanotubes. Other carbon nanomaterials produced include carbon nanofibers, carbon nanoparticles, and a new material we named carbon nanoporous balls. RMC

WINNER *Malaysian Solid State Science & Technology Society (MASS) Award – IPTA Research & Development Exposition 2003.*

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Development of Biopesticide for Managing Cruciferous Vegetable Pest

Ahmad Said Sajap, Mohammad Abdul Bakir, Hussan Abdul Kadir and Norani Abdul Samad

Award Winner

This research reveals the potential of a nucleopolyhedrovirus for development of a biopesticide for managing cruciferous vegetable pests.

In this study an armyworm *Spodoptera litura* (Fabricius) (Lep., Noctuidae), an important pest of many crops including cruciferous vegetables, was selected. The virus, coded as SpltNPV, originally isolated from Telong, Kelantan, was tested for its infectivity to the armyworm at different temperature, pH and ultraviolet radiation.

The result shows that mortality significantly increased by 47% from 53% when the larvae were reared at 20°C to 100% at 30 and 35°C. The LT_{50} values decreased from 24 to 6 days. All virus suspension used in the experiment induced mortality to more than 90% except in pH 11, where it was 64% and 100% mortality was recorded from pH 7. The LT_{50} increased to about four folds when the pH of suspension was increased from 7 to 11. SpltNPV was, however, adversely affected by UV-light. Laboratory and field trials using UV-protectants show that the virus remained infective and subsequently gave a comparable yield of *Brassica rapae* as compared with that of the chemically treated crop.

Thus SpltNPV has the potential to be commercially developed for biopesticide of armyworm, *S. litura*. RMC

GOLD – Malaysian Plant Protection Society (MPPS) Award – IPTA Research & Development Exposition 2003.

Reader Enquiry

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A Glance at Research Inventions & Innovations at UPM[1]

Continued from Issue 2, 3rd Quarter (Sept.2003)...

No.	Faculty/ Institute	Researcher	Innovation	Research Cluster	Project Number	Allocation
29.	Agriculture	Mohd. Razi Ismail	Precise control of irrigation, nutrition and microclimate for high value vegetables in soilless culture using automation and computer control	AFF	01-02-04-0082 EA001	RM156,000
30.	Agriculture	Mohd. Ridzwan Abd. Halim	Commercial production of a complete rice straw -based feed for intensive ruminant production	AFF	01-02-04-0083 EA001	RM255,000
31.	Agriculture	Mohd. Yusof Hussein	Enhancing biological control of Asiatic corn borer through habitat and vegetative diversification	AFF	01-02-04-0400 EA001	RM142,000
32.	Agriculture	Radziah binti Othman	Improved yield of onion (Allium ascolonium) through combined inoculation with rhizobacteria and arbuscular mycorrhiza	BAB	01-02-04-0098 EA001	RM126,000
33.	Agriculture	Radziah binti Othman	Enhancement of sweet potato quality through combined application of bacteria and arbuscular mycorrhiza on organically amended soil	AFF	01-02-04-0097 EA001	RM191,000
34.	Agriculture	Rita Mohamad	Development of resistance in the cocoa mirid Helopeltis theivora	AFF	01-02-04-0101 EA001	RM150,400
35.	Agriculture	Rosenani binti Abu Bakar	Improvement of production system for organic leafy and fruit vegetables	AFF	01-02-04-0104 EA001	RM135,880
36.	Agriculture	Rosenani binti Abu Bakar	Low input fertilization management to enhance soil productivity and grain corn yields	AFF	01-02-04-0103 EA001	RM291,000
37.	Agriculture	Rosli Mohamad	The effect of herbicides on performance of vesicular arbuscular mycorrizhal fungi		01-02-04-0687-EA001	RM0
38.	Agriculture	Saleh bin Kadzimin	In Vitro propagation and conservation of indigenous orchid species	AFF	09-02-04-0448 EA001	RM127,000
39.	Agriculture	Sariah Meon	Development of an effective formulation technology and delivery of biocontrol agents for the control of soil-borne diseases	BAB	01-02-04-0109 EA001	RM199,000
40.	Agriculture	Shamshuddin bin Jusop	Ameloration of soil acidity using organic-based fertilizers and natural silicate for cocoa growth	AFF	01-02-04-0503 EA001	RM150,000
41.	Agriculture	Shamshuddin bin Jusop	Alleviation of acid soil infertility in the Kemasin- Semarak IADP for rice cultivation	AFF	01-02-04-0111 EA001	RM147,000
42.	Agriculture	Sharifah Kharidah Syed Muhammad	Development of Hydrolysed Vegetable Protein from Winged Bean	AFF	03-02-04-0416 EA001	RM65,240
43.	Agriculture	Siti Hajar Ahmad	Improvement of commercial ripening technology of Cavendish banana	AFF	01-02-04-0115 EA001	RM196,000
44.	Agriculture	Siti Zauyah Darus	Accumulation Of Heavy Metal Resideus In Leafy And Root Vegetables Grown On Different Soil Types In Johor	AFF	01-02-04-0490 EA001	RM180,000
45.	Agriculture	Siti Zauyah Darus	Distribution of heavy metals and polyaromatic hydrocarbon in the estuarine ecosystem along the Larut-matang to Krian coastline, Perak	MEE	01-02-04-0118 EA001	RM185,000
46.	Agriculture	Syed Omar Syed Rastan	Control of "Padi Angin" (Weedy Rice) infestation using growth regulators and anaerobic direct seeding techniques	AFF	01-02-04-0402 EA001	RM199,000
47.	Agriculture	Thohirah Abdullah	Commercial environment-controlled production of indigenous ornamental zingibers for potted and cut-flower production	AFF	01-02-04-0517 EA001	RM166,000
48.	Agriculture	Zaharah Abdul Rahman	Sustainable grain maize production in agroferestry system	AFF	01-02-04-0126 EA001	RM175,620
49.	Agriculture	Zainal Abidin Mior Ahmad	Studies on Cladosporium-Phyllosticta foliar disease complex in banana of improved management	BAB	01-02-04-0127 EA001	RM101,000
50.	Agriculture	Zakaria bin Wahab	Selection and characterization of maize genotypes for water stress (drought) tolerance	AFF	01-02-04-0129 EA001	RM168,000
51.	Agriculture	Zulkifli Hj. Shamssuddin	Enhancement In Yield Of Oil Palm Inoculated With Plant Growth Promoting Rizobacteria (PGPR)	AFF	09-02-04-0497 EA001	RM270,000
52.	Agriculture	Zulkifli Idrus	Alleviation of heat stress related problems in broiler chickens through nutritional manipulation	AFF	01-02-04-0405 EA001	RM167,000
53.	Computer Science and Information Technology	Abdul Azim b. Abd Ghani	The Development of Web-Based Software Certification Model	ITM	04-02-04-0175 EA001	RM225,000
54.	Computer Science and Information Technology	Abu Bakar Md. Sultan	Hybrid Genetic Algorithm for University Class Timetabling		04-02-04-0802-EA001	RM0
55.	Computer Science and Information Technology	Mohd. Hasan b. Selamat	Knowledge Management in Collaborative Environment	ITM	04-02-04-0182 EA001	RM231,000
56.	Economics and Management	Abu Sofian bin Yaacob	Study of the effectiveness and compliance on critical areas in self-assessment tax system	EMA	05-02-04-0189 EA001	RM77,040
57.	Economics and Management	Ahmad Zainuddin Abdullah	Sunk Cost, entry and exit barriers in selected manufacturing industry	EMA	05-02-04-0531 EA001	RM107,000
58.	Economics and Management	Ahmad Zubaidi Baharumshah	Trade, Current Account and the Exchange Rates in Asian 6 Economies (Singapore, Thailand, Malaysia, Philippines, Indonesia and Korea).	EMA	05-02-04-0532-EA001	RM150,260

[1] Data refers to IRPA RM-8 (as of Sept Cycle 3, 2003): 379 EAR Grants.

to be continued...

†The description of the some of the above Inventions and Innovative research products available for commercialisation at UPM are contained in the book—"R&D at UPM: Creating New Frontiers of Innovative Research", First Edition, Editor: Nayan Deep S. Kanwal, Published by Research Management Centre (RMC), UPM, available from Publications & Promotion Unit, Administration Building, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor Darul Ehsan, Malaysia, Tel: +603 8946 6028, 8946 6192, Fax: +603 8942 6539, e-mail: rschinfo@admin.upm.edu.my

Synthesis Reportage

Professor Fatimah Md Yusoff, the outgoing deputy director, RMC

Associate Professor Nor Aripin Shamaan, the new incoming deputy director, Research Grant Unit, RMC

Ms. Siti Nurulhuda, Publications and Promotion Unit, RMC

1 Professor Fatimah Md Yusoff, outgoing Deputy Director, Research Grant Unit, Research Management Centre (RMC) leaves the Centre on 30 November 2003 with profound memories of her commitment and dedication to the Centre. Ever since her appointment in January 2002 as the deputy director, she was very instrumental in shaping the Research Grant Unit and successfully laid a strong foundation for the unit. It was her significant contributions and sheer ardor that the Research Grant Unit made moves to expand and beef up its services. Overall, it was an eventful year for the unit.

She left the Research Management Center to be the new Head of the Marine Science Laboratory at Institute of Bioscience at UPM effective 1 December 2003. She could now be reached at 03 8946 6621 (Office), 8946 6770 (Marine Lab), H/p.012 292 7763 or via email at fatimamy@fsas.upm.edu.my

2 Dr. Nor Aripin Shamaan, Associate Professor and Lecturer in Biochemistry from the Faculty of Science and Environmental Studies has been appointed as the new incoming Deputy Director, Research Grant Unit, Research Management Centre effective 1 December 2003. It is anticipated that the Research Grant Unit will continue to forge ahead with new initiatives and growth under his guidance and management.

He can be reached at 03 8946 6188 or via email at naripin@rmc.upm.edu.my

3 Ms. Siti Nurulhuda Abu Seman has joined as a Research Assistant to assist the Publications Division of the Research Management Centre (RMC) with effect from 20 October 2003.

Patents — transferring new inventions towards commercial markets

UPM research grants have risen steadily over the years to a record of RM 185.5 million for RM 7 (1996-2000), placing the university as the nation's leading research institution. For the first two years of RM-8 (2001-2005), UPM managed to obtain considerable funds for research. The year 2003 saw the emergence of various research outputs. Apart from the increase in number of publications in international and national journals, patents applications also soared from 17 in 2002 to 58 in 2003. Patents are important mechanism for realizing the fruits of research and for transferring new inventions towards commercial markets. In a nutshell, a patent can be considered as a contact between society and the inventor. In exchange for complete description of their invention, "society" gives the inventor the exclusive legal right to exploit the invention for a limited time.

To facilitate UPM researchers to patent their innovations, UPM has allocated RM 500,000 for the management of patent application. Researchers at UPM can apply for patent through the Research Management Centre (Policy, Planning and Finance Unit) and a patent agent will be appointed to assist them with drafting of patent specifications. Upon completing the drafting process, an application will be filed at the Patent Office at the Ministry of Domestic and Consumer Affairs. You may contact Dr. Zulkifli Idrus, Deputy Director, Policy, Planning and Finance Unit at 03 8946 6185 / 6186 or via email at zulkifli@agri.upm.edu.my

MRT – Latexmeter for latex-based industries (Patented MY 106441A) – Inventor: Professor Kamal Khalid, Faculty of Science & Environmental Studies, UPM

HO Meter – strength measuring device for hard soil / weak rock (Patented US 6650550B2) – Inventor: Assoc. Prof. Hezami Omar, Faculty of Engineering, UPM

Letters to the Editor

If you have any comments about the content of the publication or any contributions that you may wish to make for the forthcoming issues, please send them to: The Managing Editor, *Synthesis*, Publication and Promotion Unit, Research Management Centre, 3rd Floor, Administration Building, 43400 UPM, Serdang, Selangor, Malaysia or via the Internet to **editor@rmc.upm.edu.my**. The editor reserves the right to edit articles for clarity and space before publication.

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Are you reading your own copy of the UPM R&D Digest?

Synthesis is the first and only quarterly R&D digest at Universiti Putra Malaysia published in March, June, September and December with the focus on award-wining innovations. It covers research happenings emerging from the various faculties and institutes across the university and provides a brief summary of some of the important research findings of the study conducted at UPM. It brilliantly features special topics that are of national interest in various fields and disciplines.

Scientists must be made aware of how important the impact of their work is and its possible applications on society and public opinion. It is hoped that this digest will provide the opportunity to interact particularly through feedback or direct mail to the scientist from either the private sector or by scientists from other government research institutions.

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